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Social Complexity: The Missing Link in a Critical Incident Reporting System

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The safe operation of complex socio-technical systems depends on the reporting of safety critical incidents by operators within a system. Through the action of reporting, systems develop the capability as learning organizations to improve human and organizational performance. The research paper will provide a social construction understanding of reporter behavior that is influenced by the safety management system and the context of reporting, within an Air Navigation Service Provider (ANSP) in Africa. A case study methodology was applied with complementing inductive coding and thematic content analysis to explore underlying explanations for underreporting behavior. Four main themes emerged: Knowledge Management, Decentralized Safety Power Distance, Shared Safety Logic and Social Construction of Safety/Efficiency. This broad thematic landscape from the four data sets was reflected against the characteristics set by Complexity Theory to produce a framework that guides the systemic approach to reporting that facilitates organizational learning and greater insight into safety risks and opportunities.

"To not be allowed to err is not to be allowed to learn" (Rochlin, 1999, p.1552).

The above statement may be true for all humans, though society expects people in certain industries to perform at an elevated standard that constitutes an error free environment (Bosk, 2000). These industries are typically aviation, petro-chemical, nuclear engineering and health care. The industries where critical incidents resulting from human error are avoided at all costs operate as complex socio-technical systems in high risk environments (or high reliability organisations) based on the realisation that a minor human error can have catastrophic consequences (Rochlin, 1999). This applies to the ANSP that participated in this study. Staender (2011) refers to the learning from critical incidents as experience that leads to expertise and states that incident reporting offers this experience in the form of a window to system weaknesses that become visible. The reporting of critical incidents is therefore an essential part of this learning process and the underreporting of incidents is likely to have a negative effect on both the occurrence of incidents, subsequent organisational learning as well as the performance of the system or insight into system risks.

Critical incidents are events or non-standard situations, with "...origin[s] in the processes, the technique, the environment and the human/team or in any combination of all these factors" (Staender, 2011, p. 209). Research indicates that the mitigation of risk inherent to complex systems in high risk industries remains dependent on the information flowing within such a system (Griffin, Young and Stanton, 2010) and this is dependent on the reporting of critical incidents. Unfortunately, literature also shows significant underreporting of critical incidents in several industries. In a study on the underreporting of maritime accidents, an estimated 50% of accidents were underreported across Canada, Denmark, Norway, Sweden, The Netherlands, The United Kingdom (UK) and The United States (Hassel, Asbjornslett and Hole, 2011). In a 1996 study in the UK health care sector it was found that 39% of hospital service workers had not reported one or more occupational injuries. This high percentage of non-reporting occurred despite the fact that 64% of such unreported injuries required medical treatment and 44% resulted in lost work time (Weddle, 1996). A study by Zellman (1991) found that 40% of health care personnel in the USA admitted to underreporting perceived child abuse.

Literature clearly shows a remarkable and persistent reality of underreporting, although critical incident reporting research was mainly focused on system design, modeling and enablers and barriers to reporting. This study applied Social Construction Theory to critical incident reporting to further the understanding of reporting behavior.

Method

As the research seeks to explain the working of the social phenomenon of reporting in detail an interpretive case study methodology was considered most appropriate. The explorative study focussed on an ANSP in Africa where the target population consisted of operational Air Traffic Controllers (ATCs) and their managerial staff. Firstly, a random sample of six Air Traffic Service Units (ATSUs) was approached for three to seven volunteers to participate in focus groups. Secondly, the same set of questions developed for the focus groups were then applied on seven interviews on Air Traffic Controllers from another five ATSUs that were purposively sampled based upon their experience of a critical incident report that was subjected to an incident investigation. Thirdly, there were seven line managers representing five of the seven ATSUs that participated in the focus groups that volunteered for managerial interviews and fourthly, a further four purposively sampled senior management interviews were conducted that explored reporting from the managerial perspective. Questions elicited observations complemented by storytelling and actual examples of experiences on the actions and inactions of managers, peers and the organisation that influence reporting decision-making. Each of the four data groups were analysed separately with specific attention afforded to differences in the social construction of reporting stemming from exposure to investigations through to investigation expectations and local construction of reporting.

Inductive thematic analysis was performed according to Hycner's (1985) thirteen step approach to gain an overall understanding of the organisation's approach to the reporting of critical incidents, its effects within the organisation, and its perceived degree of success against the backdrop of corporate structures, positions and roles, social interactions and reproduced social structure (Edvardson, Tronvoll, and Gruber, 2011). This was achieved through a classification process of coding, thematic identification and clustering from collection to analysis phase.

Results

The thematic content analysis showed no noteworthy differences in the responses from frontline operator focus groups versus the interviews with reporters exposed to incident investigations. More detailed themes were however prevalent amongst the investigated reporters than the focus groups, for example with themes such as value contribution, multiple realities, trust and self-preservation. Interestingly though, line manager responses had more similarities with investigated reporters, especially on the themes of understanding context of a report or unreported incidents. Other similarities included the realisation of a need for multi-faceted methods to facilitate organisational safety learning and the detrimental implications of a risk measurement tool that they shared with reporters. These managers rather measured reporting success against the amount of verbal queries from their subordinates on reportability of incidents more so than the actual number of written reports filed.

Senior management themes had similarity with line managers and investigated reporters on the part of system optimisation although the context of incidents and especially underreporting was not prevalent. Critical incident reporting at an upper echelon was purely a matter of mandatory reporting guided by a disciplinary code. This linear approach to reporting was echoed in incident reporting as an expression of a corporate safety ratio – a mere number to report on, while on the contrary the other three respondent groups experienced this phenomenon as the cause of an organisational disconnect that dilutes the essence of reporting – improving safety. Decentralised safety governance was a prominent theme that surfaced across all four data sets as a necessity for safety.

Across the four data sets and 1455 codes, the main themes emerged with associated subthemes. Twenty nine supporting themes were identified that are not discussed due to volume constraints. The main themes are:

Table 1.
Overarching Themes across Four Data Sets.

Main Theme	Associated Sub-themes
Decentralized safety management power distance	Value contribution
	Self-preservation at multiple levels
Shared safety logic	Corporate positioning of reporting
Social construction of safety versus efficiency	Context focused
Knowledge management	System wide trust
	Social coherence on reporting

To illustrate the strengths of themes some paraphrases are noted and explained. For example, respondents showed signs of despair through the shrugging of shoulders, frowns or a deep sigh, resulting from the competing demands that are perceived as forcing an operator not just to judge the context but also to evaluate the potential consequences of reporting the critical event. In other words self-preservation emerged from competing consequences. When operators realized that an incident had occurred, their first thought was likely to be about self-preservation, as described by a participant: "The first thing I think about is how it is going to affect me?" This consideration is in addition to the strong emotional impact that incidents have on operators: "A very stressful time, very stressful, it takes a toll on literally everything, family, personal. Emotionally you're up and down the place." This causes underreporting in some instances, not because of personal loss or gain but the measure of safety applied can sway reporting behaviour, 'Some people actually, you know, have an incident without anyone noticing and they wouldn't report it because now it would sort of increase the safety ratio.'

What drives corporate reporting? In this case the researcher was referred to the Disciplinary Code – a stimulus to socially constructing reporting. This stemmed from an industry regulation that makes incident reporting compulsory.

Some of the focuses on reporting and the associated organizational response was depicted as '… because now you feel like your boss is already standing against you and they haven't even started the investigation yet.' '… it looks like they're out to get you, you know.' '… but you must be narrowed down to be a culprit.' On the other hand, the decision to report a critical incident requires judgment on the part of the operator and usually involves specific situations that require the operator to interpret possibly applicable rules with the situation to conclude on a decision to report. One respondent described this process as follows: 'It's a procedural reduction but I mean it's not like … a safety event [critical incident], it's not, it doesn't really affect safety.' Critical information goes astray…

Discussion

Power distance was reflected in the need for self-preservation and consistent with other studies that identified the risk of liability, the burden of reporting (Evans, Berry, Smith, Esterman, Selim, O'Shaughnessy & De Wit, 2006) and self-interest (Blanthorne and Kaplan, 2008) as reasons for underreporting. The word choice of respondents, such as 'culprit,' 'afraid' and 'punishment' reflected Mahajan's (2010) findings that reports were inhibited by views that only 'bad' professionals make mistakes. The Blanthorne *et al*. (2008) findings that the value and purpose of a report was not the only driver of reporting, but that individual consequences were a deciding factor, holds true for this study. The study also found that team consequences were a deciding factor and moreover that managerial levels also responded to incident reporting in a self-preservation fashion, despite evidence of ownership towards safety across organisational levels.

The professionals who participated in the research considered the context of an incident to play a substantial role in judging whether an incident was reportable. This is supported by findings from Wagner, Harkness and Gallagher (2012); however the themes disclosed that reporting comes to its own right in a safety management system when the focus is on value contribution beyond judging context for reportability. In the same light Tourtier, Auroy and Grasser (2010) has cautioned against oversimplifying reported incidents masking hidden risks. Therefore, shared safety logic is required with an appropriate amount of organisational energy afforded to reporting. The level of energy afforded will depend on the level of tension between the requirement for incident reporting and the performance measure of reducing incidents that presents a contradictory dilemma. Although accountability is needed and assumed by participating respondents, the tension is aggravated by misaligned social constructions of efficiency and safety when not seen as two polarities on the same continuum (Dekker, 2007).

Knowledge management closes the thematic loop as experiences of blaming and reprimand, as discovered by Firth-Cozens, Redfern and Moss (2004) in the medical industries inhibited reporting, while the theme of relationship management shaped by trust surfaced as key to reporting. Social coherence on reporting changes the view on what to report but also how to report as it links again with the value contribution of a report as oppose to human error. The understanding of themes from an organisational behaviour perspective was found to be better understood from a Complexity Theory stance.

A Complexity Framework

The main themes were mapped against the complexity characteristics set by Cilliers (1998) and a framework was derived that guides the approach and understanding towards reporting behaviour as a social construct within a complex socio-technical environment beyond the formal design of a reporting system in Figure 1.

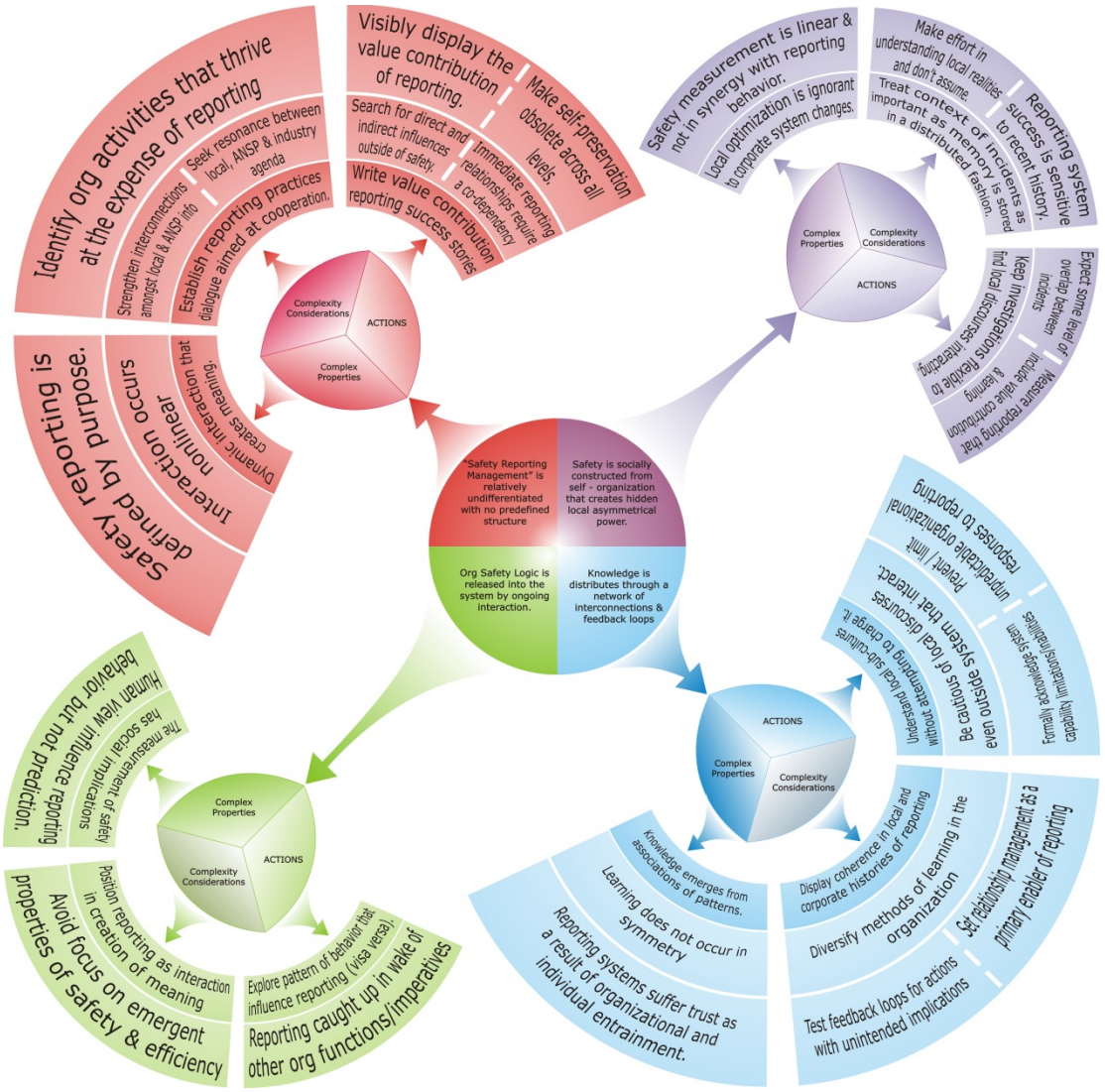

Figure 1. *A Complexity Framework to Map Reporting Markers*

Decentralized Safety Management Power Distance (value contribution & self-preservation at multiple levels)

The framework brings to the fore a fulcrum of organisational behaviour that gently directs the flow of organisational energy pertaining to reporting. For instance, embracing the asymmetrical power within the system and allowing it to shift as the relativity of safety actions shift and framing a co-dependency as the reporter to be as accountable and responsible to safety as the senior level manager embraces the reality of complex reporting behaviour. This embracement evolves from dynamic dialogue across hierarchical lines, a system's approach that seek individual and organisational gain from reporting as well as defining reporting by its value contribution. The reporting landscape also has to be scanned for power distance risk markers that can distress reporting behaviour, for example, a lack of resonance between corporate and local safety aims, organisational activities such as a disciplinary practice/code that exist at the expense of reporting (entrainment). A final prominent risk marker is that self-

preservation across levels within an organisation because a tolerance for self-preservation only exists when the focus distracts away from safety (red sector).

Shared Safety Logic (corporate positioning of reporting)

As a safety system is dependent on the information flowing internally, an Organisational Safety Logic is required that can only be affected from thorough interaction amongst stakeholders that creates meaning. This of course means that reporting has to be correctly positioned in the system as a safety pillar and a basic activity while not becoming a mere capturing tool of human fallibility or diluted by perceived more important system activities. The organisational safety logic (that reporting forms part of) can only be made prominent through patterns made explicit by continuous coherent communication across levels and units that is unique but that overlaps (green sector).

Social Construction of Safety versus Efficiency (context focused)

Safety and efficiency is socially constructed at a local level in an ANSP and this also fuels self-organisation and an automatic emergence of asymmetrical power upwards – the power of choosing not to report. This is possible because local performance is ignorant to system wide behaviour. To explain this better, complexity theory indicates that reporting behaviour is non-linear and fluid and therefore not bound by any corporate rules while being sensitive to recent history – how the last reporter was treated influences my behaviour. In the same light a reporting memory (knowledge) is stored in a distributed fashion which makes the context of each incident important to the extent that flexibility is required when investigations are performed for safer systems. Safer systems expects measurement, however reporting in itself was not measured, which in turn creates the construction of being less valued and where measured, it was limited to volumes of reporting instead of what is important to reporters and the system, e.g. learning and value contribution (purple sector).

Knowledge Management (System wide trust & social coherence on reporting)

Once a report has been tendered, knowledge management lies at the heart of that act. The themes of the data illustrates that the complexity of knowledge has to be applied to improve knowledge management. In other words, knowledge distribution occurs through a network of interconnections with multiple recursive feedback loops and learning therefore does not occur in symmetry but rather by association of patterns. The most important of these patterns are relationship patterns as reporting requires an appropriate level of intimacy amongst the transmitters and receivers. This suggests that an ANSP should be cautious of local discourses' interaction that may distort the predictability that reporters expect from the system while also demanding honesty towards the limitations of the system if quality reporting is expected corporately but the processing capability contains inabilities (blue sector).

The limitations of the study include the small sample size as well as the fact that the sample was restrained to a single organisation within the African aviation industry. Moreover, the study was performed by an ex-air traffic controller that introduces a particular frame of reference. Further research is proposed in complex high risk socio-technical organisations to test the proposed framework for applicability. It may also be valuable to explore how cultural differences may influence the social construction of reporting across different demographic group, although no noticeable differences surfaced during this study within a multi-culture environment. It is foreseen that the framework can even possibly be adapted into a scoring mechanism to assess safety critical reporting practices across industries.

Conclusion

The application of the complexity characteristics on the social construction of reporting themes from the study, point towards fluidity in a reporting system despite the assumption that a safety service is highly regulated. However, high risk industries or so called high reliability organisations can benefit exponentially from an understanding of the social construction of reporting as an integral part of the design and operation of a critical incident reporting system. This though requires a decentralised safety governance (not structure) approach and a knowledge management philosophy that embrace value contribution that makes self-preservation across levels obsolete. Inevitably such core practices improve organisational learning from critical incidents and performance insights of systems that revolve around safety - a journey that can be facilitated by the Complexity Framework.

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